

Claims

- [c1] 1. A method for determining and updating a projected strategy for maintaining optimal operations of a nuclear reactor based on one or more optimization input parameters and/or reactor state-point information stored in a database, comprising the steps performed by a computer or computer network of:
- a) accepting input data for initializing or modifying one or more optimization input parameter values which collectively define a particular reactor operation strategy;
 - b) computing optimized quantitative values for a plurality of reactor core operational control-variables based on current reactor plant state-point data, wherein the computed optimized quantitative values meet predetermined design constraints for the reactor; and
 - c) displaying, on a display device coupled to said computer or computer network, at least one or more of said computed optimized quantitative control-variable values, said information being indicative of a projected strategy for optimal reactor performance.
- [c2] 2. The method of claim 1 further including the step of computing optimal reactor simulation results based on optimized quantitative values computed in step (b).
- [c3] 3. The method of claim 1 wherein the step of computing optimized quantitative values for a plurality of reactor core operational control-variables further comprises computing polynomial response surface data based on a plurality of reactor core operation simulations.
- [c4] 4. The method of claim 1 wherein the step of computing optimized quantitative values for a plurality of reactor core operational control-variables further comprises using predetermined polynomial response surface data to predict optimal changes in independent control-variable values, said polynomial response surface data based on a plurality of reactor core operation simulations.
- [c5] 5. The method of claim 1 further including the step of periodically computing updated values for one or more optimization inputs in accordance with a

current time and/or a time remaining in a current fuel cycle.

- [c6] 6. The method of claim 1 wherein optimization input data of step (a) comprises predetermined stored optimization input parameter values which collectively define a preferred operational strategy.
- [c7] 7. The method of claim 6 wherein a stored reactor operational strategy incorporates reactor plant licensing requirements.
- [c8] 8. The method of claim 1 wherein optimization input data of step (a) is automatically retrieved from a database of optimization input data.
- [c9] 9. The method of claim 1 wherein optimization input data of step (a) is manually input by a user.
- [c10] 10. The method of claim 1 further including the step of selectively displaying historical and/or current reactor plant performance data.
- [c11] 11. The method of claim 1 wherein computation of optimized control-variables is performed in response to changes made to an existing or preferred reactor operational strategy.
- [c12] 12. The method of claim 1 further including the step of converting thermal and/or reactivity margin data into fuel cycle energy data.
- [c13] 13. The method of claim 1 further including the step of converting reactor fuel cycle energy data into thermal and/or reactivity margin data for subsequent display via graphical user interface.
- [c14] 14. The method of claim 1 wherein computing optimized quantitative values for one or more reactor core operational control-variables is performed in response to poor or inadequate process computer and/or design simulator predictions.
- [c15] 15. The method of claim 1 wherein computing optimized quantitative values for one or more reactor core operational control-variables is performed for a reactor during a given fuel cycle, N, so as to improve efficiency of reactor operations for a subsequent fuel cycle, N+1.

- [c16] 16. The method of claim 1 wherein the step of computing optimized quantitative values for one or more reactor core operational control-variables is performed and/or an optimal projected reactor operational strategy is displayed in direct response to one or more specific commands input via graphical user interface.
- [c17] 17. The method of claim 1 wherein the step of computing optimized quantitative values includes displaying all independent control variables via graphical user interface.
- [c18] 18. The method of claim 1 wherein the step of computing optimized quantitative values includes utilizing exposure dependent constraints.
- [c19] 19. The method of claim 1 wherein the step of computing optimized quantitative values includes providing multiple solutions from varying constraint criteria.
- [c20] 20. The method of claim 1 wherein the step of computing optimized quantitative values includes performing computations based upon a user selected extended reactor fuel cycle duration value.
- [c21] 21. The method of claim 1 further including the step of computing a maximum fuel cycle energy corresponding to a particular reduced coolant flow capability.
- [c22] 22. The method of claim 1 further including the step of performing a coastdown reduction computation.
- [c23] 23. The method of claim 1 further including the step of computing a maximum undisturbed sequence length.
- [c24] 24. A nuclear reactor operations optimization system for determining and updating one or more strategies for optimal operations of a nuclear reactor plant based on one or more optimization input parameters and/or reactor state-point information stored in a database, comprising:
a plurality of optimization system host processors coupled via a digital communications network, at least one or more of said host processors operative as a control-variable optimization engine and at least one or

more of said host processors providing a graphic user interface for selecting optimization inputs and inputting associated parameter values and/or displaying information indicative of an optimized operational strategy based on optimization output results provided by the optimization engine; and
a database storage device accessible by one or more of said host processors via the communications network for storage of optimization inputs and parameter values.

- [c25] 25. The reactor operations optimization system of claim 24 wherein at least one or more of said host processors process one or more reactor core operation simulation cases corresponding to a predetermined set of independent control-variable values.
- [c26] 26. The reactor operations optimization system of claim 24 wherein reactor state-point information is produced by a reactor simulation process performed by one or more of processors connected to the network and is stored in a database accessible via the communications network.
- [c27] 27. The system of claim 24 wherein the communications network comprises a LAN.
- [c28] 28. The system of claim 24 wherein the communications network comprises a WAN.
- [c29] 29. The system of claim 24 wherein the communications network comprises, at least in part, existing Internet communications infrastructure.
- [c30] 30. The system of claim 24 wherein the display device includes a graphical user interface that enables retrieval and selective display of historical and/or current reactor plant performance data stored on one or more storage devices accessible via the communications network.